

Appl. No. 10/765,808
Amdt. dated 04/09/2008
Response to Office Action of 01/10/2008

Attorney Docket No.: N1085-00256
[TSMC2003-0899]

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REMARKS/ARGUMENTS

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Claims 1-12 and 29-33 are pending in the subject patent application. Claims 1-7, 9-12 and 29-32 were allowed and claims 8 and 33 were rejected.

Applicants respectfully request re-examination, reconsideration and allowance of
5 claims 8 and 33 in addition to previously-allowed claims 1-7, 9-12 and 29-32.

Applicants take this opportunity to thank Examiner Moore for clarifying, in a telephone conversation that took place on January 24, 2008, that the subject Office Action is a NON-Final Office Action as indicated on the Office Action Summary sheet, even though paragraph 22 of the Office Action states that it is a final Office Action.

10 I. **Allowable Subject Matter**

Applicants acknowledge with appreciation the Examiner's indication, in paragraphs 18 and 19 of the subject Office Action, that claims 1-7, 9-12 and 29-32 are allowed.

II. **Claim Rejections – 35 U.S.C. § 103**

15 In the subject Office Action, claim 8 was rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,489,249 to Mathad et al. ("Mathad") in view of Japanese Patent No. 2000208492 to Yamashita. Also in the subject Office Action, claim 33 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Mathad in view of Yamashita and Japanese Patent No. 20020161262 Nagaiwa et al. ("Nagaiwa").

20 Applicants respectfully submit that each of these claims rejections is overcome for reasons set forth below.

Independent claim 8 recites the features of:

25 at least one of said chuck and said focus ring set formed of a material that includes oxygen therein such that said oxygen is released when an etching operation is carried out, said focus ring said including ... a lower focus ring disposed

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completely below said upper focus ring and directly underneath said substrate.

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Independent claim 33 recites the features of:

5 a focus ring set formed of a focus ring material that includes oxygen throughout the focus ring material such that said oxygen is released when an etching operation is carried out, said focus ring set including ... a lower focus ring disposed completely below said upper focus ring and directly underneath a portion of said substrate.

10 With respect to each of these rejections, the Examiner alleges that Mathad provides a "lower focus ring (30) disposed completely below said upper focus ring and directly underneath said substrate", referring to FIG. 3. The Examiner also acknowledges that Mathad does not teach that the oxygen is impregnated in the material of the focus ring and then relies upon Yamashita: "Yamashita discloses the
15 use of a focus ring formed of a material than [sic] includes oxygen impregnated therein (i.e. existing in quartz) for the purpose of preventing the in-plane uniformity of a semiconductor wafer from being damaged", paragraph 7, subject Office action.

 Applicants respectfully point out that one of ordinary skill in the art would not replace the silicon disc 30 illustrated in FIG. 3 of Mathad, with a member formed of
20 anything other than silicon, much less an oxygen impregnated material such as provided in Yamashita. This is because Mathad clearly teaches away from making this modification.

 Mathad is entitled ELIMINATION/REDUCTION OF BLACK SILICON IN DT ETCH and is completely directed to providing a silicon conductor member in adjacent
25 relationship with a quartz focus ring. Mathad teaches that the addition of a silicon disc provides an improvement over the prior art which only includes a quartz focus ring. Mathad states, in column 3, lines 30-32 "In general, the invention is accomplished by the addition of a silicon disc, preferably silicon, in the form of a ring adjacent to a

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normally present insulating quartz ring". Mathad further provides in column 5, lines 5-34:

5 In the embodiment of the invention shown in FIG. 2, the quartz ring design 20 is modified by the insertion of a silicon conductor 21 in adjacent relationship to the quartz ring. This modification has the effect of flattening the Vdc sheath boundary 22 at the periphery of the wafer 23, to effectively defocus the ions 24. Addition of the silicon disc to modify the existing quartz ring is such that, since the disc is made of the same material as the wafer, the voltage developed in this peripheral area is the same as that over the wafer, and results in an extension of the flat sheath boundary well beyond the wafer edge, as can be seen in FIG. 2.

10 In FIG. 2 the direction of ions as indicated by the arrows show the manner in which the ions strike the edge of the wafer. The ions are now, as a result of this modification, normal to the wafer surface and, therefore, unfocused. It has been found that the sheath of this new Vdc sheath boundary reduces the mask erosion at the wafer edge (since the etch rate of the BSG is dependent upon ion energy), and serves to protect the silicon surface from exposure to the plasma during the entire DT etch process.

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25 For example, in the lower electrode assembly of the invention modification shown in FIG. 3, the silicon disc 30 is disposed beneath quartz focus ring 31 and the silicon wafer 32 bears substantially the same relationship to Vdc sheath boundary 33 as is shown in the invention in FIG. 2.

30 Mathad is clearly directed to adding a SILICON ring – formed of the same material as the wafer being processed, to a focus ring arrangement, to provide the advantages as above. The new member located in proximity to the focus ring is therefore NECESSARILY a silicon member. One in possession of the Mathad embodiment illustrated in FIG. 3 – the embodiment in which the silicon disc is disposed underneath the substrate – would certainly NOT switch the material of this silicon disc to that of quartz or an oxygen impregnated material, because it would defeat the inventive

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purpose of Mathad. Mathad does not provide a focus ring directly underneath the substrate and formed of a material that includes oxygen therein and absolutely teaches away from replacing silicon disc 30 with a material that includes oxygen therein because then the advantages described above and which were achieved by replacing the prior art focus ring formed only of quartz, with a silicon disc, would not be achieved.

The Mathad teaching would therefore discourage one of ordinary skill from replacing the silicon disc with a quartz material such as provided in Yamashita. Mathad therefore teaches away from using the quartz provided in Yamashita because, for a reference to be considered to teach away from a proposed modification such reference must criticize, discredit or otherwise discourage the proposed combination, *In re: Fulton*, 73 USPQ 2d 1141 (Fed. Cir. 2004).

Because one of ordinary skill in the art would **not** replace the silicon disc of Mathad with a quartz material, each of claims 8 and 33 is distinguished from the references of Mathad and Yamashita. With respect to claim 33, the Nagaiwa reference has apparently been relied upon for providing a temperature-maintained focus ring and Nagaiwa does not make up for the above-stated deficiencies of Mathad as Nagaiwa provides a focus ring formed of "conductive ingredients, such as silicon and silicon carbide" as in the translation provided in the Japan Patent Office database.

Claim 8 is therefore distinguished from Mathad in view of Yamashita and claim 33 is therefore distinguished from Mathad in view of Yamashita and Nagaiwa, and, as such, the rejection of claims 8 and 33 should be withdrawn.

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CONCLUSION

Based on the foregoing, each of pending claims 1-12 and 29-33 is in allowable form and the application in condition for allowance, which action is respectfully and expeditiously requested.

- 5 The Assistant Commissioner for Patents is hereby authorized to charge any fees necessary to give effect to this filing and to credit any excess payment that may be associated with this communication, to Deposit Account 04-1679.

Respectfully submitted,

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